

# Comments on EPRI / E2I Activities Related to the U.S. Department of Energy's Gridworks Initiative

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Electricity Innovation Institute

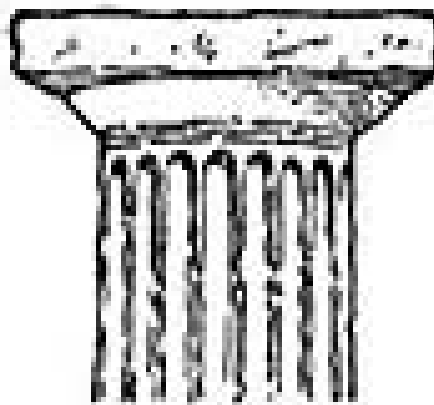
October 20, 2004

# Background: Deployment of New Technologies Needed for America's Future Electricity System

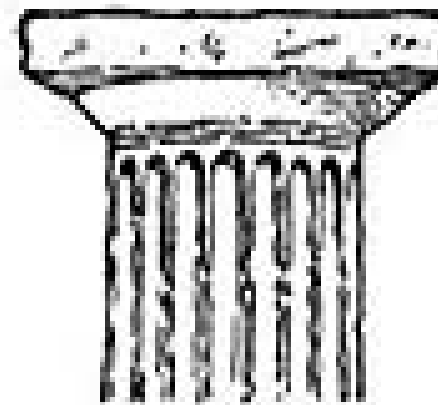
## Electric System of the Future



**Grid Modernization**



**Global Climate Change**



**Infrastructure Security**

# Transforming Society



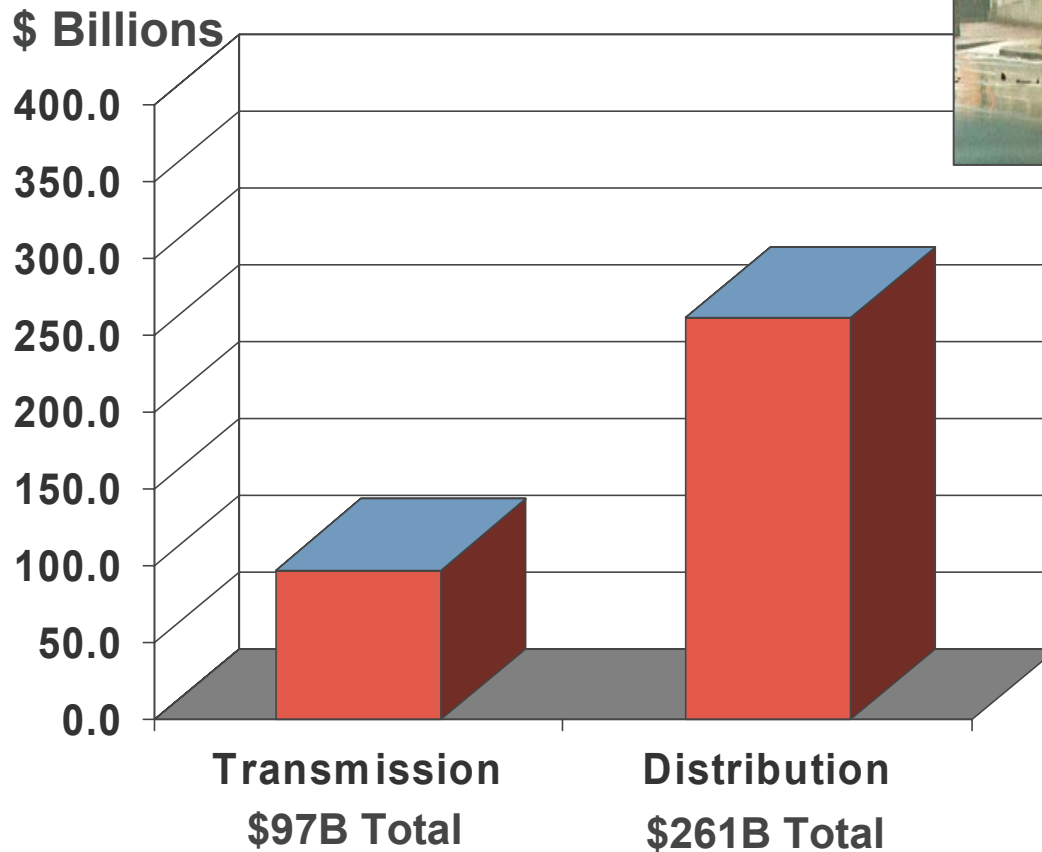
**The vast networks of electrification are  
the greatest engineering achievement of  
the 20th century**

**– U.S. National Academy of Engineering**

# Current T&D Infrastructure

Inadequate from the standpoint of:

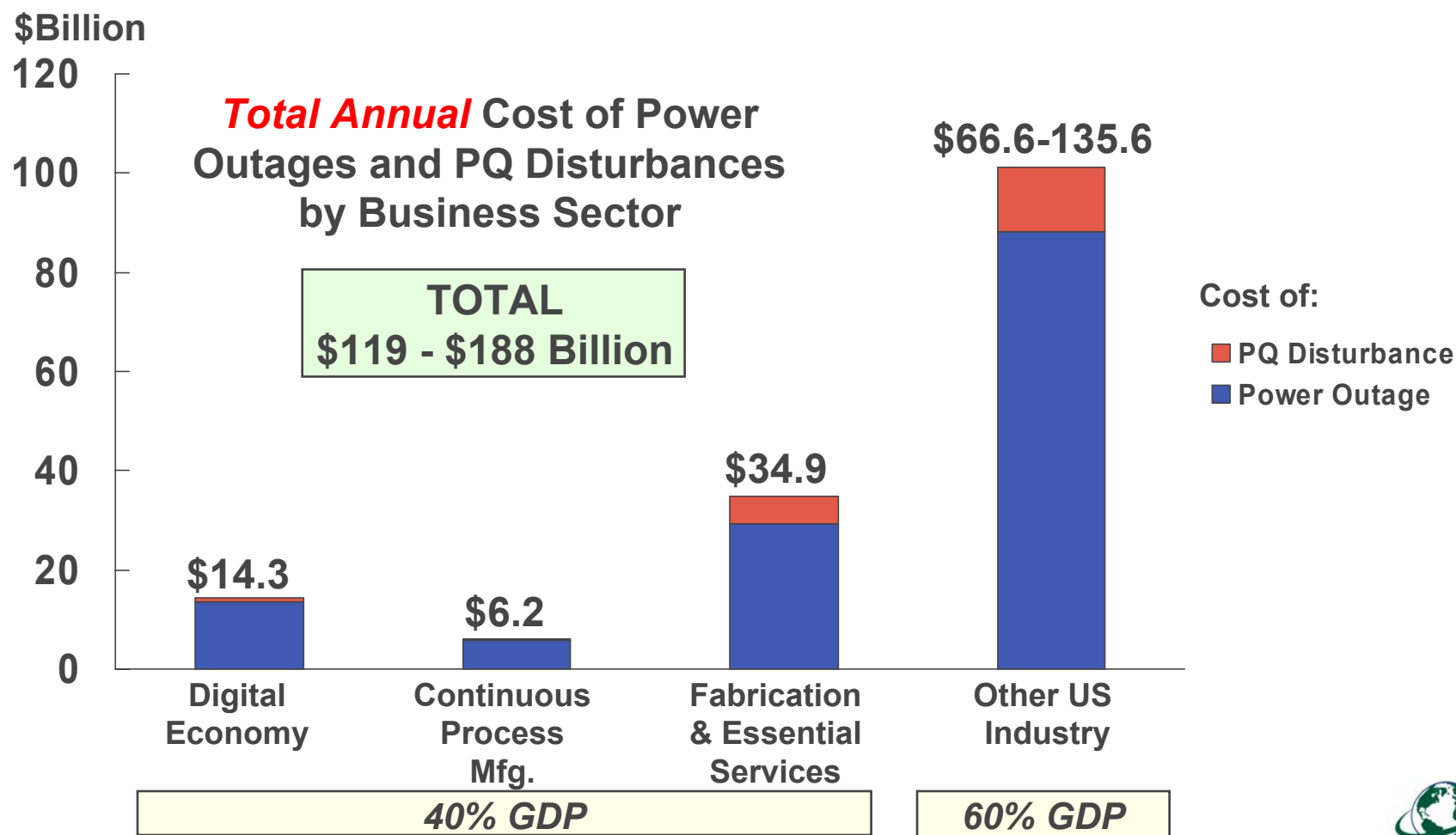
- Grid modernization
- Infrastructure security



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- 1900's design
- 1950's technology
- 21<sup>st</sup> Century end-users

# A Toll Felt Throughout the U.S. Economy



Source: Primen Study: The Cost of Power Disturbances to Industrial & Digital Economy Companies

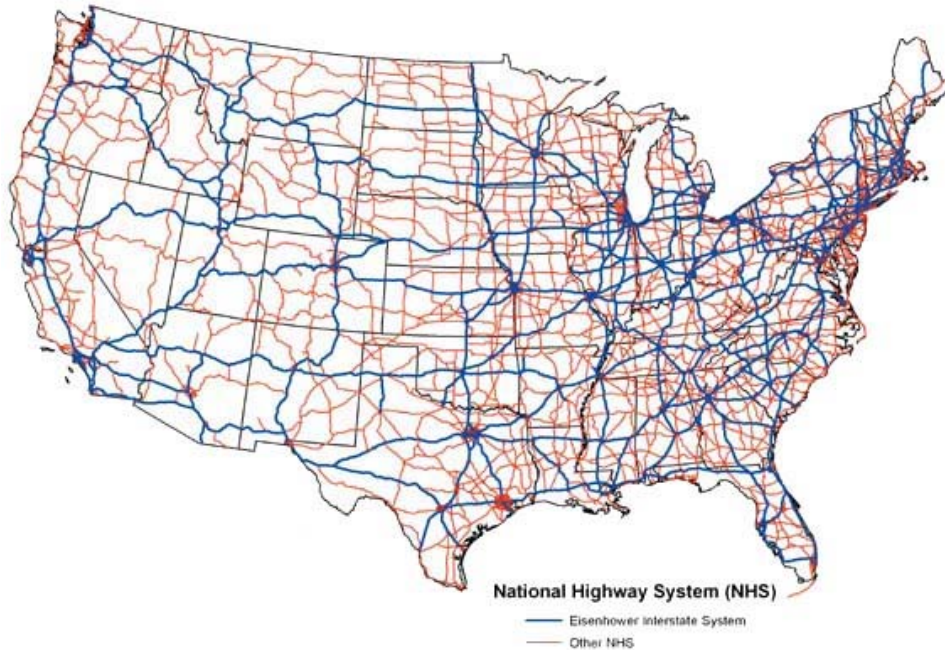
# We Need to Modernize the Grid to Address 21<sup>st</sup> Century Realities

- Increase system capacity
- Improve asset utilization
- Address infrastructure security
- Relieve bottlenecks
- Address power quality needs of a digital society

## **Requires integrated systems approach which couples:**

- Gridworks (hardware) and Gridwise (software)
- Development of Government/Industry/End-User collaborations

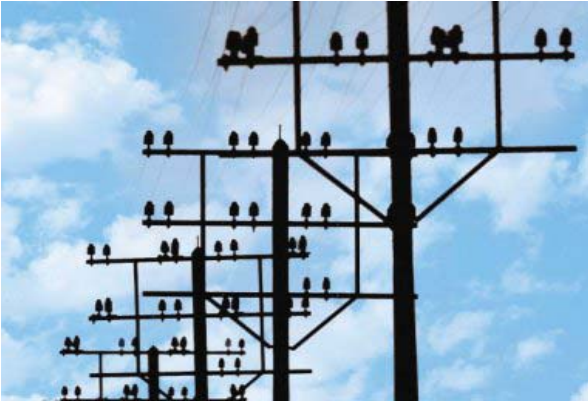
# Increase System Capacity



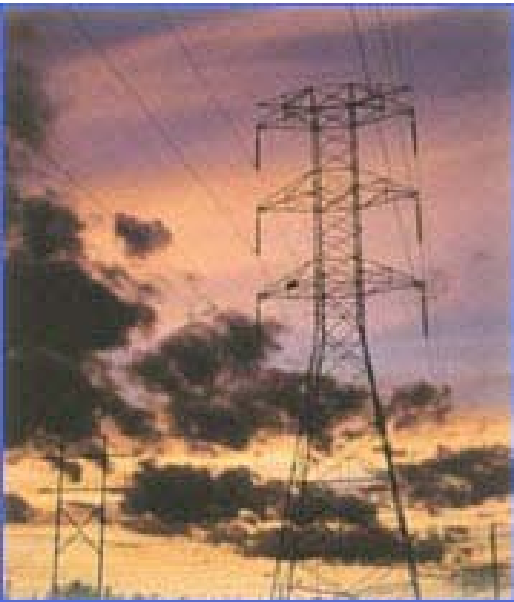
- Build more transmission circuits
- Substations and lines up standards
- Data infrastructure improvements
- Upgrade control centers
- Update protection schemes and relays



# Improve Asset Utilization

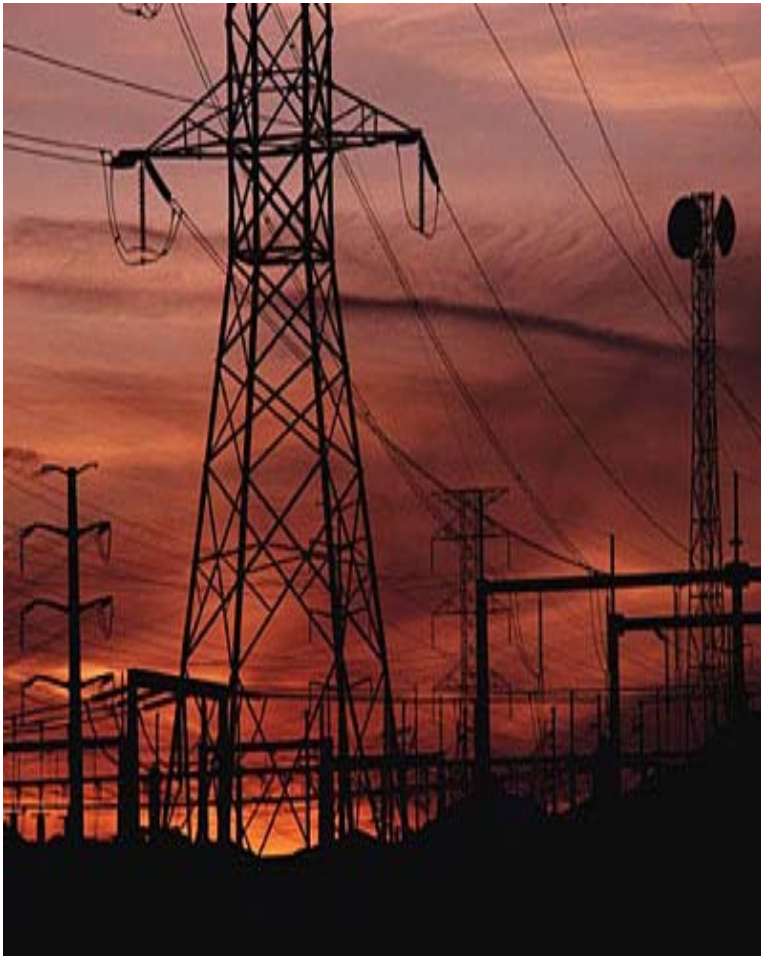


- New rights-of-way are limited by lack of power line corridors
- Enhance asset utilization through advanced power electronics





# Address Infrastructure Security



- Electric power systems are targets of terrorist attacks:
  - Physical: system replacement concerns, such as transformers
  - Cyber

# Relieve Bottlenecks

- Increase power flow
- Dynamic circuit operation
- Enhance voltage support
- Manage fault currents
- Utilize energy storage
- Develop demand response mechanisms



# Uncertainty Impedes Advances: System Owners Must Make Long-Term Financial Commitments in an Uncertain Business Environment

- Ownership issues
- Lack of regulatory clarity in rate recovery
- Financial community wariness
- Environment / permitting issues
- Low rate of return on investment
- Complex systems require thoughtful planning and integration

# What Are Roadblocks to Achieving This Grid of the Future?

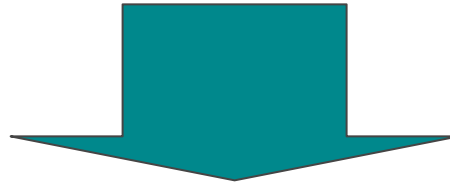
- Standardization
- Connectivity
- Regulation
- Technology



# Other Industries Have Faced Similar Issues and Overcome Barriers

- Integration of disparate systems
- Large complex systems
- Need for interoperability, scalability, upgradeability and security

Aerospace, Software Industry, Telecommunications



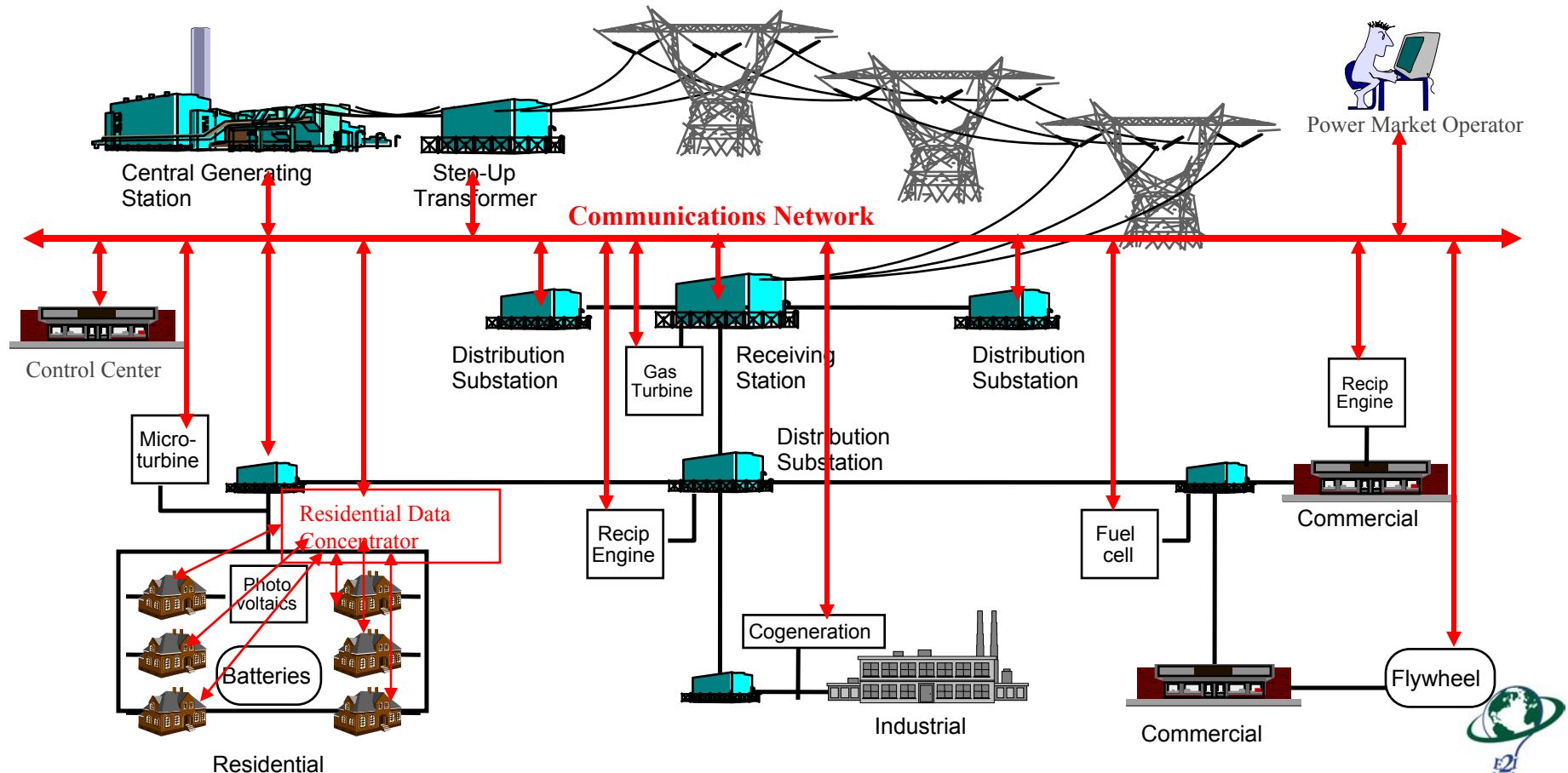
**Systems Engineering Methods**

**Modeling**

**Open Standards / Standardization**

**Technology Advances**

# Consortium for an Electric Infrastructure to Support a Digital Society: An Example of Multi-Sectoral Collaboration





# CEIDS Partners

## U.S. Utilities

- Alliant Energy
- Bonneville Power Administration
- Consolidated Edison Company
- Long Island Power Authority
- New York Power Authority
- Salt River Project
- TXU
- We Energies

## International Utilities

- Polish Power Grid Company
- Electricite de France

## Public Agencies

- U.S. Department of Energy
- California Energy Commission

## Business & Industry

- United Technologies

# CEIDS Advisory Committees

## Public Sector

- **Public Service Commissions**
  - Michigan
  - Texas
  - Georgia
  - New Jersey
- **State Energy Offices**
  - California
  - Oregon
  - Wisconsin
- **Federal Energy Regulatory Commission**
- **New York State Energy Research and Development Authority (NYSERDA)**
- **International Brotherhood of Electrical Workers.**
- **National Association of Regulatory and Utility Commissioners**
- **National Association of State Energy Officials**

## Technology

- **Motorola**
- **IBM**
- **Computer Associates**
- **Honeywell**
- **Intel**
- **Microsoft**
- **Sun**
- **Panasonic**
- **Booz Allen**
- **Cisco**

# Critical Management Component for System: Deploying Power Electronics

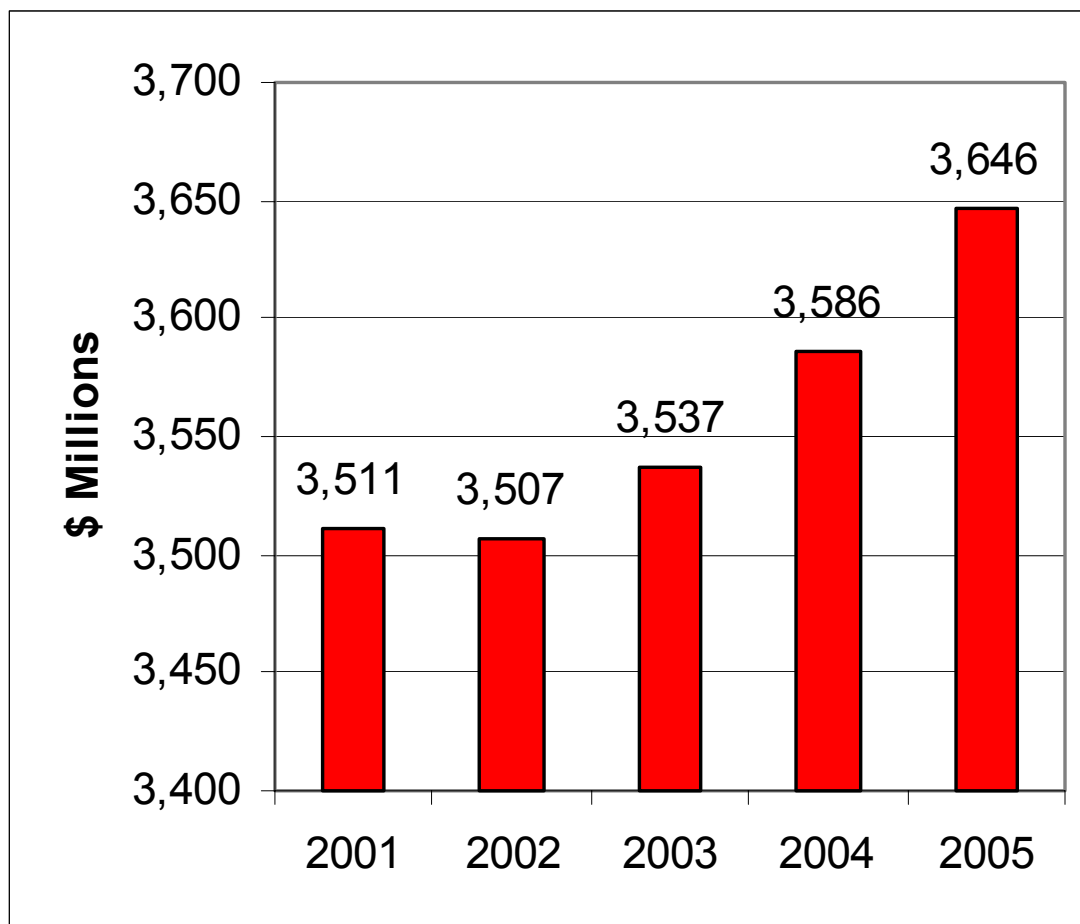
- “Intelligent” transformers
- Power electronics-based controllers
- Fault current limiters



# We Need to Accelerate Replacing 1950s Technology, With.....

- Faster, cheaper, better equipment – computerized, solid state, with integrated communications
- Compatible, standardized designs – common system architecture and standards for future compatibility
- System integration software and tools
  - Integrated communications
  - Intelligent, self-diagnostic systems
  - Fast simulation and modeling
  - Automatic, instantaneous emergency response systems, with automatic fault correction and restart
  - Distributed energy resource integration
  - Customer portal links for on site equipment and applications
- Lots of demonstration and pilot projects

# Incrementalism: Is Integration Occurring?



**Revenue from Telecom Equipment and Services  
Sold to U.S. Gas & Electric Utilities**

# Some Vital Steps Toward Gridworks Future

- New family of digital, solid state electronic controls is needed
  - Smaller, faster and cheaper for millions to be deployed
  - Scalable families of devices
  - U.S. based manufacturing capability
  - Developed in cooperation with the industry that will use them
- What's needed:
  - Solid state circuit breakers
  - Real-time power electronic controllers with instant communications
  - Advanced, scalable solid state transformers



# EPRI / E2I Commends DOE / OETD

- **A set of programs is required to incrementally improve the long-term well-being of the electricity system**
- **Public/private partnerships are critical**
  - Public good must be met
  - End-user must be connected to the process
  - Somebody's got to make some money
- **Market readiness critical to success**
- **Education: Public decision-makers, regulators, NGOs, and end-users**

# In All of These Activities Stakeholder Consultation Can Be Exhilarating

